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<b>13. ABSTRACT (Maximum 200 Words)</b> Active duty military personnel commonly are exposed to physically high-load environments. This can often result in spinal trauma as a cause of back pain and back problems. Treatment of these spinal injuries may allow for return to duty of some of these soldiers when treated in an optimal fashion. Construction of our biomechanics lab is under way and will test the following: Treatment of back pain due to spinal trauma; increase understanding of biomechanical effects of spinal reconstruction for spinal trauma; characterize effects on adjacent segments of various spinal reconstruction techniques at the thoracolumbar junction; characterize effect of corpectomy reconstruction using a cage/polyethylene cylinder. Lab is slotted for completion on May 10, 2004. To date: we have hired a project manager (2/04) and an associate research coordinator (10/03), purchased the MTS (biomechanical testing) machine and a Fluoroscopy C-arm, completed the asbestos abatement, ordered the lab furniture and begun construction. The first research protocol has been written and is pending IRB approval. On March 22, 2004, we are hosting a tri-service forum in which military specialists will discuss the current impact of spinal injuries to high-risk military personnel and detail how current advancements in this surgical arena may be used to retain special-operations fighting forces and pilots in their trained military professions.			
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## **Introduction**

Spinal pathology is common in adults. In the military, active duty service members have at least a similar rate of back pain and back injury compared to the civilian sector. Excessive spinal impact loads in military members frequently results from a faulty parachute landing or an aircraft ejection seat event. In both cases, an exponential degree of impact loading occurs to the axial spine, specifically at the thoracolumbar junction, a junction between the very stiff thoracic spine with the rib cage and the very mobile lumbar spine. Injuries at this level are recognized as the most common site of pathology for paratroopers and a common site of pathology for aviators. Currently, fixation of these injuries results in medical disqualification. These soldiers and airmen, per the current medical standards of retention, are subsequently rendered unable to continue military service in their highly-trained fields of expertise. Currently, there is no good data quantifying the relative, post-surgical adjacent segment load increases. Consequently, there is no existing data that adequately quantifies the degree of risk in post surgical soldiers and airmen in comparison to those with "normal" spines. By utilizing human anatomic tissue and observing the effects of instrumentation in neutral kyphotic and lordotic alignments at the thoracolumbar junction, we will be more able to quantify the degree of adjacent segment loading; thus providing a measure of the relative risk of returning these individuals to their prior levels of military training. Specifically, we plan to characterize the intervertebral disk loading and facet joint loading at the supra- and subjacent segments in relation to an instrumented L1 fracture pattern.

## **Body**

This project plans to focus on 2 main areas of research as outlined in the *Statement of Work*:

1. Aim 1: To characterize the effects on adjacent segments of spinal instrumentation at the thoracolumbar junction, as would be encountered in fixation for thoracolumbar fractures.
2. Aim 2: To characterize the effect of corpectomy reconstruction using a cage, varying size, stiffness, and placement on overall construct stiffness.

### ***Problems encountered:***

1. The first Military Spine Conference was scheduled for April of 2003, but was cancelled due to the start of Operation Iraqi Freedom.
2. The Primary Principal Investigator retired from the service prior to the commencement of any work being accomplished on the proposed biomechanics lab.
3. Asbestos was found on the site of the future biomechanics lab and abatement was required.

LTC(P) Timothy Kuklo was named Primary Investigator in September of 2003. Since that date we have hired a Program Manager (2/04), an Associate Research Coordinator (10/03), an active duty military consultant to plan, coordinate and execute clinical trials (12/03), and construction of the lab has begun (3/1/04). The completion of the biomechanics lab is scheduled for 10 May 2004.

Additionally, The first Military Spine Conference, will be held on 22 March 2004 at the Alexandria Mark Hilton, Alexandria, VA. This conference is a tri-service forum in which military spine specialists will discuss the current impact of spinal injuries to high-risk military personnel and detail how current advancements in this surgical arena may be used to retain special-operations fighting forces and pilots in their trained military professions.

The Agenda From the surgical perspective is three-fold:

1. Forum and discussion with military spine specialists (neurosurgeons and orthopaedic surgeons) throughout the nation to meet and present a series of case scenarios (cervical, thoracic, and lumbar) with varying interventions. Discuss medical disposition recommendations (not necessarily in accordance with regulations, but rather medical opinions), battlefield management and medical evacuations. Additionally, try to briefly assemble and review evidence about effects of spinal fusion, specifically related to adjacent segment problems, and the role of emerging technologies. One of the goals for the conference is to generate a concordance of agreement on what the level of increased risk is on adjacent segments given various interventions (i.e. if it is 1 or 2% increase or 50-100% or greater). If the information is not known, then we hope to establish a priority of effort list about how to generate such information.
2. Identify additional research priorities to optimize the care and return to duty for all service members, as related to spine problems. This will include the areas of biomechanics, treatment options/recommendations and surgical techniques for spondylolisthesis, burst fractures, and disk anomalies.
3. Review and discuss current medical evacuation policy / procedure as it pertains to battlefield spine injury cases. Open constructive dialog with Air Force Surgeon General appointees to review and discuss specific problem areas and case scenarios as encountered through recent war-time efforts.

### **Key Research Accomplishments**

- The first ever Military Spine Conference tri-service forum is being held 21-22 March 2004.
- Essential staff has been hired.
- Protocols are currently under Internal Review Board (IRB) review.
- Construction is under way, slotted completion date of 10 May 2004.
- Biomechanics equipment has been ordered, arrival date 3 May 2004.

### **Reportable Outcomes: Pending**

## **Conclusions**

From the conference, we expect to generate a concordance of agreement on the level of increased risk on adjacent segments given various interventions. Establish research priorities for return-to-duty for all service members with spinal injuries. Lastly, develop a consensus on treatment and disposition recommendations, particularly in regards to battlefield management and medical evacuation, of soldiers who have sustained spinal injuries.

*So what:* Reaching a concordance of agreement on research priorities and a consensus on treatment and disposition recommendations will provide spine patients optimal, standardized care throughout the armed forces. Spine surgeons from all services will have an established surgical community open to joint research projects and a forum for which to generate a current standard of care for treatment throughout the armed forces. Battlefield management, specifically triage, and medical evacuation has become increasingly important in the subsequent treatment of the injured soldiers.

Once the biomechanics lab is functional (6/04) we expect to study the following as outlined in the SOW:

Characterize the effects on adjacent segments of spinal instrumentation at the thoracolumbar junction, as would be encountered in fixation for thoracolumbar fractures. Characterize the effect of corpectomy reconstruction using a cage, varying size, stiffness, and placement on overall construct stiffness.

Furthermore, we expect to generate additional joint research projects from the Military Spine Conference, ultimately providing state-of-the-art surgical and treatment interventions to all spine patients, specifically total disc replacement effects and their role in spine care for active duty members.